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ABSTRACT

A study sought to determine what relationships existed between speech rate, speech pitch variation, speech loudness, and the personality assessments made by listeners. The subjects, 214 undergraduate speech communication students, listened to one of eight tape recordings made by a male speaker to represent all the combinations of the three independent variables. The listeners' responses were recorded on questionnaires containing scales for judging the speaker's voice and a set of 16 personality traits. There were significant overall differences in personality judgments attributable to the three independent variables. These main effects varied along two separate dimensions of personality (potency and amiability). The impact of the three variables conformed to patterns that were not the same for both dimensions. These results indicated that when listeners offered their judgments of the personality of an unknown male speaker based only on the speaker's voice, their perceptions of three features of the voice were significantly related to such personality judgments. (RL)

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AN INVESTIGATION OF THE INTERACTION EFFECTS OF THREE VOCAL MANIPULATIONS ON JUDGMENTS OF SPEAKER PERSONALITY

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AN INVESTIGATION OF THE INTERACTION EFFECTS OF THREE VOCAL MANIPULATIONS ON JUDGMENTS OF SPEAKER PERSONALITY

Over the past forty years, numerous empirical studies examining the relationship between characteristics of speakers' voices and personality impressions formed by listeners have been reported (e.g., Kelly, 1938; Kramer, 1963; Addington, 1968). Such studies, as well as others, have sought to discover what characteristics of certain voices result in particular judgments about the speaker's personality. Numerous vocal characteristics (e.g., pausing, phenomena, nasality, pitch variety) have been analyzed as to their influence on judgments of certain personality traits (e.g., dominance, extroversion, politeness, apathy). As research of this kind has progressed, efforts have focused on the isolation of specific vocal cues and the underlying judgments which listeners have reached. In recent investigations, it has become important to examine how the combined manipulations of separate vocal variables have been perceived by listeners in relation to the speaker images the listeners formed. The purpose of this study was to analyze the relationship between listener perceptions of three nonverbal, vocal variables (rate, pitch variation, and loudness) in the voice of one speaker, and the impressions formed of the speaker's personality.

Personality Impression Formation

Impression formation processes are thought to be a function of tendencies to judge personal attributes as being similar to those which exist as organized images in the minds of perceivers. Hastorf, Schneider, and Polefka (1970, pp. 10-17) note that when perceiving other individuals, we tend to structure our perceptual experiences, our experiences are relatively stable, and these experiences tend to be meaningful to the extent we can identify with them.

Such tendencies have been explained through implicit personality theory, a concept proposed by Bruner and Tagiuri (1954).

Implicit personality theory research has commonly examined the relationships expressed by individuals when they compare various trait names. This approach results in patterns among the traits individuals believe are associated. Noting this common approach, Schneider (1973, p. 305) states that there is no reason why any attribute of persons cannot be used in the implicit personality theory paradigm. According to this line of reasoning, if groups of individuals have notions about the personality attributes of others, then there should be some agreement among subjects who make personality judgments about the same individuals. Facial features (Secord, 1958) and style of dress (Gibbins, 1969) have both been linked with personality assessment. Although past research into vocally-cued impression formation has not made reference to implicit personality theory, the voice would seem to be a quite suitable stimulus which observers would be willing to use as a basis for judgment. That Addington and others have found agreement among listeners in their judgments of speakers' personalities is evidence that people do have some implicit theories of personality which relate to vocal features. Such evidence suggests that individuals can perceive particular aspects of speakers' voices, that they have had personal exprrience with vocal features, and have organized this into relatively stable images, and that they are able to relate a given voice to an image they have come to maintain.

Research on Nonverbal Aspects of Voice and Speaker Personality

The Addington study referred to earlier was one of the more extensive analyses of voice and personality. The study utilized four speakers in tape recorded messages of standard content. Nine vocal characteristics (orotundity, nasality, breathiness, flatness, thinness, tenseness, and three levels of rate

and pitch variation) were separately manipulated. No comments were made on the basis for selection of these particular vocal features. Subjects responded on a personality scale with 40 trait names and their opposites. He found an average correlation among subjects' trait assessments of .81. A factor analysis of the ratings for his two male and two female speakers revealed that males were perceived in terms of social faculties. In his discussion of results, Addington suggested that vocal features ought to be manipulated in a combined manner. He further speculated that such combinations would likely not yield additive effects, but rather would interact with each other.

More recent studies have made detailed analyses of vocal features and resulting personality judgments. Brown, Strong, and Rencher (1973) manipulated rate, intonation, and overall pitch through the use of two electronic methods, a rate changer and a computerized voice synthesizer, and compared these with natural, unaltered voices. After hearing a tape of these various voices (reciting several short sentences), subjects rated the voices for realism. It was found that the rate-changed voices were mistaken for normal voices 78 per cent of the time and the synthesized voices were mistaken 50 per cent-58 per cent of the time. In separate analyses, variation in intonation and rate were correlated with personality judgments recorded on a 22-item trait scale. Factor analyses revealed benevolence and competence dimensions. When intonation variation increased, there was a significant increase in the speaker's benevolence ratings, while decreases in intonation variation resulted in significantly decreased benevolence. There was an insignificant tendency for increased intonation variation to produce increased competence ratings, and decreased intonation variation to yield decreased competence. In two analyses of speech rate, one manipulation involved three levels of rate, and another involved five levels. Again, benevolence and competence factors emerged. For three

levels of rate variation, there was a significant tendency for competence to decrease as rate decreased, but decreased rate had no effect on benevolence ratings. When rate was varied in five levels, a decrease in rate resulted in significantly lowered competence ratings, while decreased rate resulted in significantly raised benevolence ratings. The authors suggested that intonation effects may vary according to individual speakers, thus using groups of speakers as they did, may not reveal the nature of the differences in personality ratings.

A second study by Brown, Strong, and Rencher (1974) used simultaneous manipulations of synthesized voices displaying variations in rate, average pitch, and variation in intonation. Using the voices of two males speaking one short sentence, each voice was synthesized into 27 possible combinations of three levels of variation in each variable, 37 subjects rated the 54 voices on a 15-item personality scale. A factor analysis produced two dimensions as before, competence and benevolence. The competence dimension was composed mainly of ratings on these traits: active, ambitious, intelligent, confident, happy, good-looking, strong, and dependable. The benevolence dimension was composed mainly of ratings on these traits: sociable, likeable, just, religious, sincere, kind, and polite. For the competence dimension, it was estimated that variance was accounted for by changes in the variables in these proportions: rate, 86 per cent; average pitch, 4 per cent; intonation variation, 3 per cent; interaction of rate and intonation variation, 2 per cent; individual speaker characteristics, 1 per cent; and all other sources, 4 per cent. For the benevolence dimension, the variables accounted for variance in these proportions: rate, 48 per cent; average pitch, 1 per cent; intonation variation, 6 per cent; interaction rate and intonation variation, 1 per cent; individual speaker characteristics, 8 per cent; and all other sources, 36 per cent.

The authors summarized their findings in these statements:

(1) As rate decreases, competence decreases.

(2) Increasing rate causes a decrease in benevolence ratings.

(3) Increased intonation variation tends to increase benevolence ratings, and decreased intonation variation causes a decrease in both competence and benevolence.

(4) Increased average pitch causes a decrease in both competence and benevolence ratings.

(5) Rate manipulations are greater and more consistent than the effects of intonation variation or average pitch.

(6) There is an interaction between effects of rate and intonation variation, but this may be a tendency for voices that are already rated as very competent or benevolent to resist further change resulting from manipulations that would ordinarily be expected to produce such a change.

In commenting on the effects of rate, the authors included in their discussion the findings from a subsequently published study on rate (Smith, Brown, Strong, and Rencher, 1975). These additional findings showed that the competence factor was much more sensitive to rate change than the benevolence factor. For benevolence, however, a curvilinear relationship was found such that as rate increased from below-normal to normal, benevolence ratings increased, but for above-normal rate, benevolence ratings decreased.

It is noteworthy that Brown, et al, identified two dimensions of personality for their male speakers, that rate was clearly the more potent vocal feature in regard to personality assessments, that rate impacted the competence dimension in a way differetn from its impact on the benevolence dimension, and that rate interacted with intonation variation. These findings represent some of the most detailed analyses of voice and personality completed to date.

As research in voice and personality continues, there is a need to carry out further investigations in a modified form in order to extend the existing findings. In this regard, several issues arise when considering the work of

Brown and his colleagues. One issue concerns the manner in which vocal variableswere manipulated. Brown, et al, found that synthesized voices were judged similar to actual voices to an extent that the electronic method of manipulation seemed feasible for further research. They had observed, however, that synthesized voices were mistaken for real voices 50 per cent to 58 per cent of the time. While these percentages are sizeable, it is not known to what extent the personality ratings of their synthesized voices would be the same for those obtained from actual voice variations.

The content of the message in this research was standard for both speakers, although it consisted of one short sentence. It is conceivable that longer utterances would make more information available to listeners, thus yielding impressions which might differ from those based on a brief voice sample.

When synthesizing the manipulations of vocal variables, as Brown, et al, did, precise acoustic descriptions of the manipulations are arrived at. Such precision makes it easier to prepare test tapes and give others in the research community accurate information as to the acoustic features of the speech sounds heard by the listeners. If used alone, however, this method of manipulation does not allow the researcher to know how the vocal features were perceived by those judging them. Regardless of the acoustic properties of a speech sound, a listener can base his impressions on only the features he perceives. It seems quite possible that different results could emerge from a perceptually-based analysis as compared with an acoustic-based analysis.

A final issue pertains to the vocal features selected for manipulation in the test tapes. The Brown, et al. group varied three vocal features: rate, intonation variety, and average pitch. Rate has been a variable of great interest in voice and personality studies, both as a manipulated variable and as a rated feature of naturally-occurring speech (e.g., Addington, 1968;

Markel, 1969; Weintraub and Aronson, 1974). As the research by Brown, et al, shows, rate changes correlate significantly with personality judgments. Aspects of vocal pitch (average pitch, pitch variation, and intonation) have also been of great interest to researchers (e.g., Addington, 1968; Friedman, Brown and Rosenman, 1969; Markel, 1969). In the study by Brown and his colleagues, however, average pitch and intonation variation accounted for less of the variance in the personality ratings than rate. Other studies (e.g., Markel, 1969; Welkowitz, Feldstein, Finkelstein, and Aylesworth, 1972; Natale, 1975) have selected vocal loudness as a speech variable relevant to personality. Inasmuch as the study by Brown, et al, failed to find substantial variance in personality ratings associated with variation in average pitch and that there were no significant interaction effects associated with pitch variation, it would seem appropriate to introduce another variable in place of average pitch. Substituting loudness for average pitch would allow for further analysis of vocal variables by introducing a vocal feature which has been shown to be of some importance in previous research.

The preceeding discussion has shown that variations in the design of earlier studies would afford a modified replication which could potentially yield new information on personality and speech. Results from such a replication would enable researchers to compare findings in a way that could further clarify the relationships between speakers' voices and implicit personalities theories of listeners. The present study sought to explore the relationship between the separate and combined effects of speech rate, speech pitch variation, and speech loudness, and the personality assessments made by listeners. Two research hypotheses were examined:

(1) There should be significant main effects from variations in speech rate, speech pitch variation, and speech loudness, on the personality judgments made by listeners.

(2) There should be significant interaction effects from the combined manipulations of variations in speech rate, speech pitch variation, and speech loudness, on the personality judgments made by listeners.

Subjects

The subjects (N = 214) for the study were solicited for their participation from among those enrolled in undergraduate speech communication classes in the spring of 1979. All subjects participated on a voluntary basis. The mean age of the subjects was 20.90 (SD = 4.18). There were 102 females and 111 males in the sample (missing sex data for one subject).

Instrumentation and Treatment Stimuli

Listener responses were recorded on questionnaires which contained scales for judging the features of the speaker's voice and a set of 16 trait scales for personality judgments. The three vocal variables were judged on 100 mm vertical line scales bounded by these descriptors: loud-soft, fast-slow, and great variety-monotonous. These scales were randomized in order in the first section of each questionnaire. The trait names used in the questionnaire were taken from three similar scales used in earlier research. Norman (1963), Addington (1968), and Mulac (1976), have reported personality scales useful in assessing implicit personality theories of perceivers. A comparison of these three sets of trait names revealed that 16 names were essentially common to all three. Because these 16 trait names covered a range of personality characteristics and because they had proven useful in these earlier personality studies, they were incorporated into the present study. The trait names and their paired opposites were placed at the end points of seven-point scales and the item order was randomized for each subject.

A pretest of three printed messages similar in length, verbal style, and general interest, revealed that one (a portion of the Rainbow Passage from Fairbanks, 1940, p. 127) was judged as the most neutral in terms of responses on an eight-item semantic differential composed of evaluative adjectives. A male speaker (age 35) unknown to the subjects agreed to prepare the audio tape recordings. In the three weeks prior to the final recording session, he practiced reading the message in eight different ways representing all combinations of the three independent variables with a low and high level of each. In order to produce differences in the message versions which would be clearly perceivable to untrained subjects, somewhat exaggerated levels of the three variables were effected. The loudness variable was audible for only a few feet from the speaker in the low condition, whereas in the high condition it was audible for a distance of many feet. When exhibiting little pitch variation, the speaker's voice was relatively monotonous, but when demonstrating great pitch variety, nearly every word was uttered at a perceptively different pitch. In the slow rate condition, there were noticeable pauses between words, but the fast rate condition was uttered as rapidly as the speaker could intelligibly speak. The final recording of each message was made during a single recording session using low noise tape, seven and one-half inches per second, on a Wollensak 1520 monaural tape recorder.

The study was designed to yield data suitable for two different statistical tests, an anlysis of variance and a regression analysis. Successful manipulation of the levels of the independent variables was intended to be verified through subjects' perceptual judgments which would reliably indicate significant differences between perceptions of the two levels of each variable. These levels would then become suitable for grouping for the analysis of variance. The regression analysis did not require significant differences in

the listener perceptions according to the manipulated variations, but only that independently varying differences existed in listener judgment.

When the recordings were pretested with a group of five judges, the perceptual judgments were not significantly different for both levels of each variable. Developing voice samples of this kind which vary significantly is not difficult to accomplish with acoustic synthesis, but accomplishing this through perceptual judgments is somewhat difficult. It appeared that samples with greater vocal variations than had already been manipulated would have produced exaggerated speech patterns beyond those which untrained subjects would perceive as falling within the range of natural speech. It was decided to proceed with the original recordings and examine the perceptual judgments made by the subjects. Decisions on appropriate statistical tests were made after inspecting the perceptual data.

Procedures

Eight different groups of volunteer subjects listened to a tape assigned on a random basis. Before hearing a tape, each subject read the instructions in the questionnaire and then heard the author briefly describe each independent variable and how to complete the questionnaire. Rate was defined in terms of number of words-per-minute. Loudness was described as the overall level of volume in the speaker's voice, and pitch variation was explained in terms of deviation from monotony. The same Sony TC-270 tape recorder was used to play all tapes with volume and tone controls fixed the same way in all cases. Subjects were seated in front of the recorder speaker and were basically seated in a semicircle.

RESULTS

Factor Analysis

For reasons of economy of analysis and the need to explore the interrelationships between the fifteen personality items, a factor analysis was performed on the personality data. An initial analysis yielded three factors, two of which accounted for most (91%) of the variance. A second factor analysis produced a two factor solution and a factor score correlation matrix. The matrix values were then used in calculating composite indices which reflected the dimensions of the personality data pertinent to each of the factors (Nie, Hull, Jenkins, Steinbrenner, and Bent, 1975; p. 488). Loadings for each of the personality trait names are listed in Table 1. These loadings show that for Factor I, values ranged from .832 and -.131, and for Factor II, the range was from .667 and -.387. In order to determine the most definitive aspects of each factor, the interpretation offered here was primarily based on the purest loadings (those higher than .600 on one factor and no higher than .300 on the other).

The purest loadings on Factor I were for these traits: active, extroverted, talkative, and headstrong. These terms suggest an irrepressible, self-willed character which made sense to think of as a potency dimension. Less pure loadings occurred for these traits: healthy, sophisticated, and emotional. That loadings on this factor were low for cooperative, good-natured, and polite suggests that some notion of socio-emotional sensitivity is not very salient to listeners when judgments were reached on this dimension. The purest loadings on Factor II were for these three traits: polite, good-natured, and cooperative. These terms seem to relate to some notion of social sensitivity and this factor was termed an amiability dimension. The only

TABLE I

TWO FACTOR SOLUTION

Personality Scale	Factor I Loadings	Factor II Loadings
educated - uneducated	.567	.329
cooperative - uncooperative	.170	.642
good-natured - irritable	.175	.654
polite - boorish	.219	.667
headstrong - weakwilled	.646	.013
active - passive	.832	..012
anxious - calm	.420	-.387
talkative - silent	.737	-.040
sophisticated - naive	.550	.260
artistically-sensitive - artistically insensitive	.326	.507
scrupulous - unscrupulous	.050	.330
extroverted - introverted	.771	.117
healthy - sickly	.557	.228
careful - careless	-.131	.473
brave - cowardly	.453	.385
emotional - unemotional	.591	.300

other loading of .500 or higher for amiability was artistically-sensitive, but it is not clear how this fits into this dimension. Judgments of activity, talkativeness, headstrongness, and extroversion are not related strongly to this dimension.

A comparison between this factor structure and that described by Brown, et al, reveals some similar patterns. In the previous studies, as was mentioned earlier, a competence factor emerged which was based on traits such as active, ambitious, intelligent, and confident. These traits seem somewhat related to those comprising the potency factor described above. Even more clear is the relationship between the earlier study's benevolence dimension (based on such traits as polite, kind, sincere, religious, and just) and the amiability dimension in the present findings in which polite, good-natured, and cooperative were key characteristics.

From the factor analysis we see that judgments of the speaker's personality were determined on the basis of two separate, underlying dimensions of listener judgment. These two factors thus formed separate, dependent variables for the main statistical analysis.

Main Analysis

Preliminary analyses of the perceptual data showed that the vocal manipulations were perceived as varying independently of each other. Pearson product-moment correlations for the three vocal variables ranged from .005 to .02 and no significant correlations were found. However, three separate three-way ANOVA's with each of the vocal variables treated as a dependent variable, indicated that the perceptual judgments were not significantly different in each case. In order to perform a three-way ANOVA, the perceptual data had to be grouped in a way that established the differences between the high and low levels of each independent variable. From a frequencies analysis, the

median for each independent variable was found and then used as a break point for new data groupings. Separating the low and high scores by this method established the independence of these levels needed for the ANOVA.

The results of the separate, three-way ANOVA's for each factor are summarized in Table II and Table III. The results for the potency factor show that all main effects were significant at the .001 level and that the pitch x rate interaction was significant at the .02 level. The rate variable clearly influenced the potency factor most strongly, with low rate resulting in a mean of -.92 (SD = 1.69), and high rate resulting in a mean of 1.15 (SD = 1.95). These rate data compare with low and high loudness means of -.43 (SD = 1.99) and .65 (SD = 1.99). For low pitch, the mean was -.42 (SD = 1.99), and for high pitch, .64 (SD = 1.96).

The one significant interaction effect in the potency factor data, rate x pitch, indicated that the effect of pitch variation is moderated by the effect of rate. Table IV contains the cell means from the interaction effects data. Whereas low pitch variation has the main effect of producing negative potency, it interacts with high rate to yield positive potency. Generally, then, the results for the potency factor show that a voice which is judged as having low loudness, slow rate, and low pitch variation will give impressions of a personality lacking potency. The opposite is true for a voice with rapid rate, high loudness, and great pitch variation, in which case the impression of the speaker will be that of positive potency. A voice with rapid rate and low pitch variation will be judged as having less potency than if rate and pitch variation were both high, but if both are high, the potency will be even higher than that due to either of the separate effects of these two variables.

TABLE II

ANOVA SUMMARY DATA FOR FACTOR I

Source	SS	DF	MS	F	P
loudness	56.78	1	56.78	21.47	.001
pitch	39.85	1	39.85	15.06	.001
rate	200.91	1	200.91	75.94	.001
loudness x pitch	.03	1	.03	.01	.914
loudness x rate	5.21	1	5.21	1.97	.162
pitch x rate	14.06	1	14.06	5.32	.022
loudness x pitch x rate	.21	1	.21	.079	.778
explained	343.32	7	49.05	18.54	.001
residual	544.96	206	2.65		
total	888.28	213	4.17		

TABLE III

ANOVA SUMMARY DATA FOR FACTOR II

Source	SS	DF	MS	F	P
loudness	7.13	1	7.13	13.01	.001
pitch	23.41	1	23.41	42.70	.001
rate	10.01	1	10.01	18.26	.001
loudness x pitch	7.44	1	7.44	13.57	.001
loudness x rate	.45	1	.45	.82	.365
pitch x rate	3.47	1	3.47	6.32	.013
loudness x pitch x rate	.37	1	.37	.68	.411
explained	49.58	7	7.08	12.92	.001
residual	112.95	206	.55		
total	162.53	213	.76		

TABLE IV

INTERACTION EFFECTS CELL MEANS

A. Factor I

Low Pitch Var., High Rate	High Pitch Var., Low Rate	Low Pitch Var., Low Rate	High Pitch Var., High Rate
-1.04 (SD = 1.86)	-.77 (SD = 1.47)	.35 (SD = 1.89)	1.80 (SD = 1.51)

B. Factor II

Low Pitch Var., High Rate	High Pitch Var., Low Rate	Low Pitch Var., Low Rate	High Pitch Var., High Rate
.005 (SD = .79)	.46 (SD = .82)	-.66 (SD = .76)	.23 (SD = .76)

Low Loudness, High Pitch Var.	High Loudness, Low Pitch Var.	Low Loudness, Low Pitch Var.	High Loudness, High Pitch Var.
-.30 (SD = .87)	-.29 (SD = .82)	.71 (SD = .72)	-.06 (SD = .67)

The amiability data show that all main effects were significant at the .001 level, and that two interaction effects were significant, loudness x pitch ($p < .001$) and pitch x rate ($p < .012$). The pattern of main effects varied from that observed for the potency factor. For the amiability dimension, a voice which exhibits rapid rate and high loudness leads to impressions of negative amiability, but a voice with great pitch variation will give impressions of negative amiability, but a voice with great pitch variation will give impressions of positive amiability. These main effects are evidenced by the subpopulation mean values for amiability. High loudness resulted in a mean of -.17 (SD = .75), and for low loudness, .21 (SD = .94). For low rate, the mean was .21 (SD = .83), and for high rate, -.17 (SD = .88). For pitch, however, the low variation mean was -.29 (SD = .84), and for high variation, .33 (SD = .79).

In the rate x pitch interaction, a cancellation effect appears to have been operating whereby the main effect of each independent variable was moderated by the other in a way that reduced the magnitude of each. When interacting with low rate, low pitch variation resulted in an amiability value of virtually zero (.01). In general terms, high pitch variation results in positive amiability regardless of rate. Low rate similarly results in positive amiability, but only slightly so when pitch variation is low. Low pitch variation and high rate produce a negative amiability rating.

In the loudness x pitch interaction, the main effect of pitch appears to have been the most influential except when pitch and loudness were both high. For the low pitch subpopulation groups, loudness had virtually no effect, and the negative amiability values were the same that would be expected from the main effects. For high pitch and low loudness, a definite interaction occurred which enhanced the positive mean beyond the additive effects of both.

Whereas high pitch variation had the main effect of enhancing amiability, when interacting with high loudness amiability took on a negative value. Generally speaking, a voice with low pitch variation results in impressions of negative amiability, regardless of loudness. High pitch variation, however, interacts with high loudness to yield impressions of high positive amiability. High loudness results in negative amiability, regardless of pitch, but only slightly so when pitch variation is high. The amiability of the speaker was relatively high in the condition of high pitch variation, low loudness.

Separate multiple regression analyses were performed for the effects of the three independent variables on each factor. The results of both analyses are summarized in Table V. The potency factor results show that portions of explained variance were 9 per cent, 3 per cent, and 20 per cent, respectively, for loudness, pitch variation, and rate (total explained variance = 32 per cent). All main effects were significant. Variation in rate thus accounted for far more of the variance in the potency dimension than either pitch or loudness. This effect apparently had greater influence in the rate x pitch variation interaction, as was referred to earlier.

The amiability factor results show patterns which are consistent with the ANOVA. Pitch variation exerted the strongest influence of the three variables. Portions of explained variance were 4 per cent, 6 per cent, and 15 per cent, respectively, for loudness, rate, and pitch variation (total explained variance = 25 per cent). All main effects were significant. Variations in loudness and rate exert a negative influence on amiability, but variation in pitch exerts a postive influence on amiability. Since pitch variation accounts for more of the explained variance than loudness or rate, these results explain why pitch variation was so influential in the interaction effects.

TABLE V

MULTIPLE REGRESSION SUMMARY

FACTOR I

Variable	B	F	P	BETA	R-SQ.
Loudness	.13	17.22	.001	.24	.09
Rate	.21	57.27	.001	.44	.20
Pitch	.80	8.55	.001	.17	.03
					.32

Overall F = 32.19 ($p < .001$).

FACTOR II

Variable	B	F	P	BETA	R-SQ.
Loudness	-.50	12.14	.001	-.21	.04
Rate	-.55	19.56	.001	-.27	.06
Pitch	.81	43.15	.001	.40	.15
					.25

Overall F = 23.05 ($p < .001$).

In terms of this study's two research hypotheses, there is sufficient evidence to accept both at a statistically significant level. Hypothesis one stated that there should be significant overall differences in personality judgments attributable to the three independent variables. Strong support for these main effects comes from the two main statistical tests in which all main effects were significant at the .001 level. In addition, these main effects varied along two different dimensions of personality and the impact of these variables conformed to a pattern which was not the same for both dimensions. That the independent variables should combine to produce significant interactions was stated in hypothesis two. Such effects, separate and different from the main effects of the independent variables, were revealed although less so for one dimension than the other. The strongest evidence of interaction came from the analysis of the amiability data, in which two of the two-way interactions were significant and the main effects of the vocal variables were altered.

DISCUSSION

Below are listed the main findings of the analysis of data.

(1) The personality of a male speaker whose voice contained simultaneous variations in loudness, rate, and pitch was judged in terms of two dimensions of personality, potency and amiability.

(2) In varying degrees, changes in loudness, pitch variation, and rate of speech had separate and significant effects on judgments of the speaker's personality.

(3) As rate, loudness, and pitch variation in the speaker's voice increased, judgments of his potency increased, rate exerting the strongest influence.

(4) In judgments of the speaker's potency, rate and pitch interacted with rate affecting pitch variation more than pitch affected rate.

(5) Low rate and low loudness each exerted a positive influence on judgments of a male speaker's amiability. High rate and high loudness each exerted a negative influence on judgments of the speaker's amiability. The influence of low pitch was negative and that of high pitch was positive in terms of a male speaker's amiability.

(6) In judgments of the speaker's amiability, pitch variation and rate interacted, with the result being a mediation of the main effects of each. Loudness and pitch variation interacted to generally produce a negative impact on amiability, except for the high pitch variation, low loudness condition in which high amiability resulted.

(7) Rate exerted more influence on judgments of the speaker's potency than either pitch variation or loudness. Pitch variation exerted more influence on judgments of amiability than either loudness or rate.

(8) Perceived manipulations in rate, pitch variation, and loudness accounted for 32 per cent of the variance in judgments of the speaker's potency. Perceived manipulations in rate, pitch variation, and loudness, separately and together, accounted for 25 per cent of judgments of the speaker's amiability.

These results indicate that when listeners offer their judgments of the personality of an unknown male speaker based only on the speaker's voice, perceptions of three features of the voice are significantly related to such judgments. Since changes in perceptions of vocal features did vary significantly with changes in personality assessments, it appears that listeners shared some notions about the personality characteristics that accompany certain voices. In other words, the evidence indicates that there were implicit personality theories present among these subjects and that such theories were complete enough to provide for some definite patterns in the inferred traits. Not only were there two dimensions of personality, but values for these dimensions changed according to certain variations in the perceived vocal features.

The present findings, along with the research reviewed earlier, provide ample evidence that the voice is a source of information suitable for the formation of impressions of personality. Beyond this general finding, we now have a basis for extending the existing knowledge on some of the patterns that emerge from such impression formation processes. The present results are fairly compatible with earlier findings in several respects. The competence and benevolence factor structures of the studies by Brown and his colleagues seem basically similar to the potency and amiability factor structure in this study. Differences in the trait names used in the personality questionnaires in the studies hinder direct comparisons, but there seems to be enough similarity to consider them as products of the same impression formation processes.

Another general finding pertains to the effects of manipulations of rate. In the present study, as well as the earlier research, increased rate tended to raise estimates of the more dynamic features of the speaker's personality. Another relationship between rate and personality is that as rate increases, ratings of amiability decrease, as was also true for the earlier findings in the benevolence dimension. In addition, the earlier finding that rate is the most influential variable in relation to judgments of competence was found in the present results as rate accounted for far more of the variance in the personality data than the other two variables. Interaction patterns seem similar as well. Previous research by Brown, et al, found a rate x pitch variation in judgments of competence and benevolence, but this was not interpreted as a true interaction effect because personality ratings were not changed much as a result of the combined effects. In the present study, the interaction effect appeared to have a definite impact on the personality ratings because the personality ratings were different than the main effects of each, as far as the potency factor was concerned. Because rate was the more influential of the two variables, rate

seemed to exert more impact on the interaction than pitch variation. For the amiability factor, pitch variation was the more influential variable and accordingly, it seemed to exert the greater influence in the rate x pitch variation interaction.

The loudness data provide new insight into speech and personality research. Not only did loudness have significant main effects in both the potency and amiability dimensions, but in the amiability data loudness figured in one of the significant two-way interactions. In particular, it should be noted that when interacting with pitch variation, loudness exerts a strong influence, even though pitch variation accounted for more of the variance in the amiability data. Furthermore, in terms of percentage of explained variance, loudness accounted for more than the variable it was substituted for (average pitch) in the design of the present study. It appears that loudness is a more potent variable than average pitch.

When making further comparisons between the present study and previous findings, one issue deserving comment pertains to percentages of explained variance. In the study by Brown, et al, rate accounted for 86 per cent of the variance in the competence factor, and 48 per cent in the benevolence factor. Pitch variation accounted for 3 per cent of the variance in the competence data, and 1 per cent in the benevolence data. In the present study, using results from the regression analysis for variance estimates, rate accounted for 20 per cent and 6 per cent, respectively, of the variance in the potency and amiability factors. Pitch variation accounted for 3 per cent and 15 per cent, respectively, of the variance in the potency and amiability factors. In the present study, therefore, rate was less influential in a general sense, and in particular, rate exerted less impact in the amiability dimension. Pitch variation accounted for about the same amount of variance in both the competence

and potency dimensions, but was more influential in ratings of amiability than benevolence. The nature of the impact of rate and pitch variation was essentially the same in both studies, but the amount of explained variance presents a notable discrepancy. Perhaps there is enough of a difference between the factor structures that some variations could be due to that difference. It has been stated that the two factor structures were similar enough to be meaningfully compared, but because the same trait names were not the same in both studies, the factors may not be directly comparable.

Another reason there were differences in the proportions of explained variance could be due to the speech samples being of different lengths. As was mentioned earlier, longer spoken messages may allow listeners to use the additional information in forming personality impressions in a way that differs from the patterns resulting from shorter speech samples. Perhaps it is the case that when listeners have a longer speech sample to perceive, they become more aware of the particular features of the voice and their personality judgments reflect this increased awareness. Judgments from longer speech samples might be based, then, on vocal features which are more proportional to each other in their impact.

Longer speech samples could also be one of the reasons the overall proportions of explained variance were less in the present study than in the previous research. The study by Brown, et al, found far greater amounts of explained variance due to the variations in the vocal variables than the present study. Perhaps the longer listeners have to think about a speaker, the more their judgments reflect awareness of attributes not evident in their ratings of the manipulated vocal cues.

Differences between the results of the two studies could also be due to one of the other design features of the present study which varied from

that of the previous research. Method of manipulation and/or method of determining the extent of manipulation could possibly yield different results, as was speculated in the first section of this paper. It is not clear which differences between the designs of the two studies are responsible for the discrepancy in the amounts of explained variance, if indeed one of these differences is responsible.

Research into personality and speech has shown some of the intricacies of the impression formation process operating when individuals respond according to their implicit notions of personality. Such knowledge can help clarify not only how various vocal features function in the impression formation process, but also the sensitivity of listeners in perceiving others' voices. Since most people encounter the speech of others with great frequency in their daily lives, speech ought to be considered a very common source of information about one's personality. Regardless of whether vocally-cued impressions of personality are truly reflective of one's character, studying the nature of the process reveals the extent to which listeners agree on their judgments.

The present research was limited in that it did not assess personality judgments reached through perceptions of naturally occurring speech and this is one important implication for future research. Using standard content messages afforded the manipulation which was needed for the close analysis which was sought. It would be interesting, however, to record naturally-occurring speech and secure personality data on that basis. It seems possible that some vocal cues which are important in personality judgment may be present in conversational speech and less present or absent in the kind of speech samples used in this study.

Another limitation concerns the method of assessing the personality of the speaker. Previous research had indicated that the trait items on the

questionnaire were relevant to implicit personality judgments, yet one may ask whether such scales were relevant for these speech samples and this particular group of subjects. If subjects had supplied their own descriptors which they felt were relevant to this setting, different personality profiles might have emerged. Future research ought to consider subject-generated trait names and compare results from those to results obtained from questionnaires constructed by the researcher.

It would also seem worthwhile to continue speech and personality research using more vocal variables and more levels of such variables. Using a large number of variables in the same study would make it difficult to analyze the data, but perhaps a series of studies using combinations of variables could eventually arrive at a relatively small number which seem to be the most important in relation to the resulting impressions of personality.

Ultimately, it would be desirable to assess the relative importance of vocally-cued personality impressions in relation to other information about stimulus persons. When other sources of information about the stimulus person is available, in particular visual sources, then speech may well function differently from its function when it is the only source.

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